



United States
Office of Personnel Management

FWS Job Grading Standard for

Electrician

2805

Human Resources Systems Service
Office of Classification
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NOTE

This standard has been converted from the original paper format to electronic format without substantive change in series coverage or grading criteria. The standard was reviewed to correct errors that may have been introduced during the conversion process. In some standards minor corrections were made such as updating references to other documents that may have become obsolete, or correcting minor typographical errors in the original standard. Any errors that remain due to conversion to electronic format should be minor and are not intended to change the meaning of the original standard.

COVERAGE OF STANDARD

This standard is used to grade all nonsupervisory jobs involved in the installation, maintenance, troubleshooting, and repair of electrical wiring systems, fixtures, controls, and equipment in industrial, institutional, office, and residential buildings, and on ships. These jobs require knowledge and application of electrical principles, materials, and safety standards.

WORK NOT COVERED

This standard does not cover work which primarily involves:

- Installing, testing repairing, and maintaining electric power plant and overhead and underground primary electrical distribution systems. (See Job Grading Standard for Electrician (High Voltage), 2810.)
- Troubleshooting, testing, repairing, overhauling, modifying, and maintaining electrical equipment. (See Job Grading Standard for Electrical Equipment Repairer, 2854.)
- Installing, troubleshooting, repairing, and maintaining aircraft electrical systems and equipment. (See Job Grading Standard for Aircraft Electrician, 2892.)
- Installing, maintaining, overhauling, repairing, and testing medical and dental equipment. (See Job Grading Standard for Medical Equipment Repairer, 4805.)
- Repairing and maintaining elevator systems. (See Job Grading Standard for Elevator Mechanic, 5313.)
- Troubleshooting, testing, and repairing automotive equipment electrical systems. (See Job Grading Standard for Automotive Mechanic, 5823.)
- Assembling, fabricating, overhauling, installing, maintaining, and repairing electronic equipment when a practical application of electronic principles is the primary knowledge requirement. (See Job Grading Standard for Electronics Mechanic, 2604.)
- Positions requiring a knowledge of the techniques and theories of electronics, including the ability to apply that knowledge to duties involved in engineering functions and a knowledge of the capabilities, limitations, operations, design characteristics, and functional use of a variety of types and models of electronic equipment and systems. (See Position Classification Standard for Electronics Technician Series, GS-856.)

NOTE TO USERS

Because of technological and operational changes, many previously electromechanical devices, controls, and equipment have been replaced by solid state devices, introducing the need in some positions for a basic understanding of electronic technology, circuitry, and controls. For example, some positions require the ability to read system diagrams and schematics, interpret electronic terms and symbols, and apply a variety of electronic formulas, tables, charts, and color codes in order to mount, ground, and install wiring and equipment for various types of electrical/electronic systems, e.g., fire alarm systems, intrusion detection systems, computer systems, sonar and radar equipment, antennas, switch panels and switchboards. Additionally, such positions usually require the ability to use test equipment, such as ohmmeters, vacuum tube voltmeters, and diode checkers to locate the problem area and identify it as electrical or electronic, and to perform simple troubleshooting such as testing and isolating defective electronic parts (e.g., diodes and silicon rectifiers) and circuit boards which the electrician may replace or refer to an electronics mechanic for repair. Positions in the 2800 Series, Electrical Installation and Maintenance Family, are not assigned the responsibility for repairing the boards or other electronic devices, and do not require the depth of knowledge or level of skill found in positions coded to the Electronic Equipment Installation and Maintenance Family, 2600. (For further discussion of the relationship between electrical and electronic positions, see the Introduction to the Electronic Equipment Installation and Maintenance Family, 2600, "Relationship with Nonelectronic Occupations.")

TITLES

Jobs covered by this standard below grade 10 are to be titled Electrical Worker. Jobs covered by this standard at grade 10 and above are to be titled Electrician.

GRADE LEVELS

The standard does not describe all possible levels for this occupation. If jobs differ substantially from the skill, knowledge, and other work requirements described in the grade levels of the standard, they may be graded either above or below these grades based on the application of sound job grading principles.

HELPER AND INTERMEDIATE JOBS

Jobs that are part of a planned program of training and development for advancement to a higher grade are graded by the U.S. Office of Personnel Management Job Grading Standards

for Trades Helper and Intermediate Jobs, Grade 10 in this standard is to be used as the full performance level in applying the Intermediate Job Grading Table.

2805-8**ELECTRICAL WORKER, GRADE 8****2805-8**

General: The work at this grade involves making repairs that can be accomplished by removing, replacing, tightening, splicing, soldering, and insulating defective wiring, controls, equipment, and fixtures such as broken and bare wiring, burned out switches and relays, loose connections and fittings, damaged light fixtures, and poorly operating thermostats. For example, from job layouts, work sequences, and material requirements that have been determined by an employee of higher level, grade 8 Electrical Workers: (a) install or repair electrical systems incident to the construction or maintenance of family housing units, buildings, quarters, offices, or shops; or (b) perform limited assignments in the installation or repair of complex industrial electrical systems.

Electrical workers at grade 8 receive work orders, oral instructions, and wiring diagrams that indicate the nature of the repair or installation to be made, the layout and placement of circuitry, fixtures, and controls, and the types of wiring, parts, and equipment installed. They locate broken, worn, damaged, or poorly operating wiring, fixtures, controls, and equipment through visual check or through use of a small variety of test equipment, for example, test lamps, voltage testers, ammeters, and polarity testers. They complete needed repairs to installed systems, and rearrange and hook up items such as outlets, switches, light fixtures, regulators, and circuit breakers.

Skill and Knowledge: At this grade, electrical workers require a knowledge of where fixtures, wiring, and controls, such as light switches, circuit breakers, fuses, relays, and outlets, are installed and how they operate. They must have the ability to read and follow wiring diagrams that specify where wiring, fixtures, and controls are installed or are to be hooked up and show the type of wiring, fittings, and equipment installed or to be used. Electrical workers must have the skill needed to remove and replace fixtures and controls, and to make repairs such as tightening connections, wrapping exposed wiring with insulating tape, and soldering loose wire leads to contact points. They must also have the skill needed to rearrange old or install new outlets, relays, switches, and light fixtures in existing systems, and to test circuits to see if they are complete after making repairs or installations. At this grade, electrical workers must have the skill needed to measure, cut, and bend wire and conduit to specified lengths and angles. They must have skill in the use of handtools and portable power tools, such as screwdrivers, pliers, wirecutters, strippers, drills, soldering irons, and manual or power conduit benders and threaders; and a limited variety of test equipment, for example, meggers, test lamps, and ammeters.

Responsibility: A higher grade worker or supervisor plans, lays out, and assigns work orally or through work orders and wiring diagrams. Grade 8 electrical worker selects tools, decides on methods and techniques to use, and carry out the work with little check during its progress. They use materials called for in work orders and schematic drawings, or obtain replacement parts by comparison with samples such as switches and wall outlet fixtures. They replace worn or bad switches, relays, and outlets by unscrewing or cutting wiring from connections, inserting the replacement, and splicing, tightening, and soldering wiring to connections. They also install or rearrange light fixtures, switches, and outlets by following schematic drawings that provide the

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exact work specifications, for example, the location where the electrical wiring is to be hooked into the installed system, the type, size, and measurements of wire, conduit, couplings, and fittings to use, and the type and placement of the electrical device to be installed. Routine repair and maintenance duties are accomplished independently; if unusual problems arise, or if installation or repair of unfamiliar or complex industrial electrical systems is assigned, a supervisor or higher grade worker provides advice and checks to see that completed work meets requirements.

Physical Effort: Electrical workers at this grade makes repairs and installations from ladders, scaffolding, platforms, and other hard-to-reach places. This requires electrical workers him to stand, stoop, bend, kneel, climb, and work in tiring and uncomfortable positions. Electrical workers frequently lift and carry tools, equipment, and parts that weigh up to 9 kilograms (20 pounds) and, less often, up to 18 kilograms (40 pounds). Occasionally, they lift or move with assistance moderately heavy objects weighing more than 18 kilograms.

Working Conditions: The work is performed both inside and outside. Electrical workers are sometimes required to make repairs and installations in bad weather; in work areas that are noisy, dirty, dusty, and greasy; on scaffolding or cranes at heights of 9 meters (30 feet) or more; and in close quarters such as manholes, attics, or aboard ships. They are occasionally exposed to the possibility of injury from falling, electrical shock, burns, and rotary devices such as electrical motors. They are frequently exposed to the possibility of cuts and bruises.

2805-10**ELECTRICIAN, GRADE 10****2805-10**

General: The work at this grade involves installing, modifying, repairing, maintaining, troubleshooting, testing, and loading new and existing electrical lines, circuits, systems, and associated fixtures, controls, and equipment. Examples of these are secondary power distribution lines and circuits used to supply a wide range of voltage, amperage, phase, and frequency requirements, to distribution panels, switchgear, power and control circuits; industrial multiphase systems; thermocouple sensors; electrical intrusion alarm and fire alarm system; emergency warning systems; lighting protection systems; high intensity lighting systems with associated controls; target mechanisms; AC and DC rectification systems; galvanic and impressed current cathodic protection systems which prevent corrosion on underground or submerged equipment and pipes; amplifier circuits; and related electrical equipment.

Electricians, grade 10, work from building plans, blueprints, wiring diagrams, engineering, drawings, and electrical maintenance and repair manuals to plan and lay out the routing, placement type, size, gauge, balance, load, continuity, and safe operation of electrical lines, circuits, systems, equipment and controls. They determine and place distribution panels, boxes, fittings, and connections and install wiring, couplings, conduit, relays, fixtures, transformers and other electrical devices including electrical service entrances.

In comparison with grade 8 electrical workers who work on residential wiring or limited portions of industrial circuitry, electricians, at grade 10 must have a greater knowledge of how various electrical systems, circuits, equipment, and controls are installed, operate, and work together to support industrial operations, computer complexes, or similar complex electrical loads. The grade 10 electricians must also have greater skill than the grade 8 electrical workers in planning and laying out work, tracing hard-to-locate defects or problems and completing

repairs and installations with little or no advice. The supervisor checks completed work only to see that it meets accepted trade standards.

Skill and Knowledge: At this grade, electricians must have a knowledge of the operation and installation of a variety of complete electrical systems and equipment, such as series, parallel, and compound circuits for single and multiple phase alternating current of varying voltage, amperage, and frequency; wiring systems in industrial complexes and in buildings; and power or regulating and control circuits and distribution panels to industrial machinery, ships' control equipment, computers or laboratory and other electrical equipment. Because grade 10 electricians plan, lay out, install, modify, troubleshoot, and repair a variety of complete systems as well as any parts of these systems, they must have greater knowledge than grade 8 electrical workers about how various circuits, equipment, and controls operate, fit, and work together. Grade 10 electricians must have a knowledge of the various gauges, sizes, and types of wire, conduit, couplings, fittings, relays, boxes, circuit breakers, and other electrical devices, and the ability to arrange and

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install them in ways that insure proper and safe operation of electrical systems and equipment. They must have the ability to interpret and apply the National Electrical Code, local codes, building plans, blueprints, wiring diagrams, and engineering drawings, and to use trade formulas to calculate common properties, e.g., voltage, voltage drop and current capability in series and parallel circuits, resistance, inductance, capacitance, power factor, current flow, and temperature, and length in single and multiple raceways, conduits, gutters, and cable trays. They must have skill in the use of handtools; power tools, such as cable pullers, hydraulic benders, and pipe threading machines; and a wide variety of test equipment, for example, meggers, multimeters, frequency meters, wattmeters, power factor meters, vibro-grounds, phase rotation meters, audio tone location equipment, high potential testers, ground fault interrupter testing equipment, recording ammeters, circuit analyzers, circuit breaker testers, resistance bridges, and cathodic protection test sets. Additionally, some positions require a basic familiarity with electronics to electronic components. For example, the electrician may recognize parts, such as resistors, capacitors, and transistors; may operate basic test equipment such as signal generators, signal tracers, and oscilloscopes; and may read schematics of uncomplicated assemblies to determine locations of defective parts.

Responsibility: Unlike grade 8 electrical workers who receive specific instructions, grade 10 electricians work from building plans, wiring diagrams, and engineering drawings. They are responsible for planning and laying out the routing, placement, and arrangement of industrial or similarly complex systems, circuits, controls, and equipment. Grade 10 electricians determine installations and repairs including such things as the types, sizes,

gauges, and lay out of conduit, wiring, couplings, fittings, relays, controls, and distribution panels, and other electrical devices used in a variety of complete electrical systems and the best methods of installation and repair.

They are responsible for safe and proper operation of systems and equipment, and for compliance with the National Electrical Code. They complete installations, modifications, and repairs, and load and test systems, circuits, equipment, and controls with little or no check during the progress or upon completion of work. The supervisor checks overall work to see that it meets accepted trade standards and is completed in a timely manner.

Physical Effort: Physical effort at this grade is the same as that described at grade 8 level.

Working Conditions: Working conditions at this grade are the same as those described at the grade 8 level.

2805-11**ELECTRICIAN, GRADE 11****2805-11**

General. The work at this grade involves nonstandard industrial or research and development applications which lack clear precedent and require extensive adaptation of methods. For example, the work is most commonly found at research and development laboratories where electricians fabricate, install, modify, and troubleshoot specialized electrical control or monitoring systems and equipment designed to meet unique conditions associated with research and development projects. The electrical systems which support the research projects or tests are regularly subjected to extreme demands for accuracy of control motion, load sensing, etc., under severe conditions such as high speed, altitude, temperature, humidity, water, icing, pressure and pressure distortions.

Electricians at the grade 11 level receive little or no technical supervision. They apply more ingenuity, judgment, and skill than electricians at the grade 10 level in planning and laying out the work to meet a variety of unique and critical requirements. Additionally, technical guides or diagrams are frequently incomplete or unavailable for the more demanding modification work or troubleshooting required.

Skill and Knowledge. Unlike the work at grade 10 which requires a knowledge of the installation and maintenance of complete industrial electrical systems and associated

equipment, electricians at grade 11 must have a thorough knowledge of the construction, installation, operation, and troubleshooting of sophisticated circuitry and controls associated with unique projects. For example, they independently formulate the layout sketch of required electrical circuits, wire new test setups, install strain gauge circuits and recording instruments as needed by the test program to measure performance of test articles, check the installed system to insure that specified electrical test conditions are attained, and may troubleshoot the electrical portions of the test equipment during test programs to determine cause of malfunction. Critical limits are controlled by intricate interlock of safety systems of novel design and great complexity. The electricians anticipate and respond quickly to danger signs as they become evident through intricate warning systems to avoid loss of time and expensive equipment. Additionally, electrical portions of items required for specific tests are especially designed and electricians use imagination and skill to construct unique and complex installations, e.g., developing prototype applications, devising modifications to hardware for use in experiments such as modifying controls or constructing feedback control systems, and developing rewiring layouts to meet project and safety requirements involving intricate interconnecting systems. They are knowledgeable of the uses of materials, e.g., special plastics, filters or outlets, that will withstand a variety of environments or other test and experimental conditions, and are knowledgeable of special safety precautions involving handling of hazardous materials such as toxic chemicals, explosive or volatile material, radiation, and asbestos. They must have the ability to use all types of shop and hand tools, and test equipment associated with the electrical trade, such as meggers, oscilloscopes, protective relay testers, multimeters, wattmeters, wheatstone bridges, and Kelvin

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bridges to check alignment, output, resistance to ground, and other electrical characteristics. Additionally, some electricians must have a basic familiarity with electronics to troubleshoot electrical circuits containing electronic components in order to isolate the cause of malfunction, whether electrical or electronic, in complex relay logic circuits for electrical control systems, computer interface devices, analog/digital controls, and solid state motor control circuits for referral to an electronics mechanic for repair.

Responsibility: Electricians at this grade must be able to plan and lay out work with a minimum of supervision. They must have the ability to work to project objectives proposed by engineers, including planning and laying out the sequence of work from drawings or blueprints which may be incomplete regarding the specific wiring required in the unique application of equipment. They receive orientation as to objectives, scheduled completion data, general

configuration, and size and capacity of equipment. They often work directly with engineers, scientists, and sponsors to build or modify electrical circuits on the basis of rough notes and desired performance criteria. They must be able to interpret engineers' and manufacturers' handbooks to learn operating characteristics and power requirements. They may be responsible for completed project requirements, timeliness, and standards of safety.

Physical Effort: Physical effort at this grade is the same as that described at the grade 8 level.

Working Conditions: In addition to the working conditions described at the previous levels, grade 11 electricians may be exposed to temperature extremes in test facilities, extremely high noise levels, and exposure to radiation, chemicals, or carcinogens.